

# PATENT COOPERATION TREATY

## PCT

### INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

REC'D 22 AUG 2003



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Applicant's or agent's file reference G3245 PCT	<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/PEA416)	
International application No. PCT/US02/15774	International filing date (day/month/year) 16.05.2002	Priority date (day/month/year) 30.05.2001
International Patent Classification (IPC) or both national classification and IPC B41J2/165		
Applicant 3M INNOVATIVE PROPERTIES COMPANY et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 4 sheets, including this cover sheet.  
  
☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).  
  
 These annexes consist of a total of 7 sheets.

3. This report contains indications relating to the following items:
  - I ☒ Basis of the opinion
  - II ☐ Priority
  - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
  - IV ☐ Lack of unity of invention
  - V ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
  - VI ☐ Certain documents cited
  - VII ☐ Certain defects in the international application
  - VIII ☐ Certain observations on the international application

Date of submission of the demand  30.12.2002	Date of completion of this report  20.08.2003
Name and mailing address of the International preliminary examining authority:   European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized Officer  Findeli, B  Telephone No. +49 89 2399-2372  

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. **PCT/US02/15774**

**I. Basis of the report**

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

**Description, Pages**

1-3, 5-11	as originally filed
4, 4a	received on 12.05.2003 with letter of 12.05.2003

**Claims, Numbers**

1-24	received on 12.05.2003 with letter of 12.05.2003
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**Drawings, Sheets**

1/2	as originally filed
2/2	received on 12.05.2003 with letter of 12.05.2003

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. **PCT/US02/15774**

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☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

*(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*

6. Additional observations, if necessary:

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)	Yes: Claims	1-24
	No: Claims	
Inventive step (IS)	Yes: Claims	1-24
	No: Claims	
Industrial applicability (IA)	Yes: Claims	1-24
	No: Claims	

2. Citations and explanations

**see separate sheet**

**Re Item V**

**Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

- 1) Claim 1 is directed to a print head unit for a drop on demand inkjet printer, including a face plate with an array of capillary channels each with an ejection nozzle and a controlled pulsing element, in which a print head body portion supports an automated maintenance device which comprises a shaped capping arm to abut the face plate so as to cover the ejection nozzles and supports a movable wiping element including a wiper blade to remove ink from the face plate after removal of the capping element and before commencement of a print run.

Such a print head unit is known from the closest prior art document EP-A-0 749 837.

The subject-matter of claim 1 differs from the print head unit disclosed in the closest prior art in that the shaped capping arm and the movable wiping element move independently of one another.

Thereby, the time for capping/decapping and wiping the print head unit can be reduced.

The technical problem to be solved by the application was therefore to speed up the printing cycle.

The solution to this problem is neither disclosed, nor suggested in the prior art cited in the search report.

- 2) The dependent claims define further embodiments and likewise meet the requirements of the PCT.

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Our Ref.: G3245PCT

May 12, 2003

European patent application EP 1016528 discloses an ink jet printer with a wiper blade cleaning mechanism for use on a print head surface. The wiper blade has a complex structure incorporating a first passageway for conveying liquid solvent to the surface. The solvent flushes contaminants from the surface and entrains them. The wiper blade also includes a plurality of wicking channels which can be aligned with the surface and a second passageway in communication with these channels. A vacuum pump in communication with the second passageway draws solvent and entrained contaminants from the surface, along the wicking channels and through the second passageway. Additionally a piping circuit filters particulate matter from the solvent and recirculates filtered solvent into the first passageway and thus onto the surface of the print head.

International patent application WO 98/45122 discloses an inkjet printer with a service station comprising a wiper device capable of cleaning the face of a print head. The main purpose for the wiper device is however to apply to the face a viscous sealing liquid so as to seal the nozzles and prevent the ink in the print head from drying. The service station stores the sealing liquid and has an applicator mechanism including a dispenser member from which sealing liquid is transferred by means of the wiper to the print head.

U.S. Patent No. 6,145,958 relates to a system for cleaning an inkjet print head by using a wiper that moves between a wiping position for cleaning ink residue from the print head, a scraping position for scraping residue from the wiper, and a solvent application position. A porous body portion impregnated with solvent moves the solvent under capillary action from a scraper portion towards an applicator and filters dissolved ink residue from the ink solvent. The applicator applies ink solvent to the wiper and the scraper scrapes ink residue from the wiper. [insert page 4a]

The present invention seeks to provide a simple automated maintenance station for wiping and capping the print head of a drop on demand inkjet printer, especially for industrial applications of the printer.

#### Summary of the Invention

According to the present invention there is provided a print head unit for a drop on demand inkjet printer, including a face plate with an array of capillary channels each with an ejection nozzle and a controlled pulsing element, in which the print head supports an

-4a-

EP-A-0 749 837 discloses means to prevent nozzle clogging of an ink-jet print head comprising a seal bonnet and a wiping lip being arranged between legs of a bow-shaped lever which is attached to a print head unit. Further, the seal bonnet is kinematically coupled to the wiping lip.

EP-A-0 671 273 discloses a protective capping apparatus for an ink-jet pen having a protective cap movable between an open position and a closed position. In the closed position the protective cap shields a portion of an ink pen such as the ink-jets or the electrical contacts.

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Our Ref.: G 3245P6

May 12, 2003

## NEW CLAIMS:

1. A print head unit for a drop on demand inkjet printer, including a face plate (12) with an array of capillary channels each with an ejection nozzle (14) and a controlled pulsing element, in which the print head body portion (10) supports an automated maintenance device which comprises (i) a shaped capping arm (16) to abut the face plate (12) so as to cover the ejection nozzles (14) and (ii) a movable wiping element including a wiper blade (29) to remove ink from the face plate (12) after removal of the capping element and before commencement of a print run, wherein the shaped capping arm (16) and the movable wiping element move independently of one another.
2. A print head unit as claimed in claim 1, in which the capping element is spring-mounted.
3. A print head unit as claimed in claim 1 or claim 2, in which a facing pad (22) of the capping element that comes into contact with the face plate (12) is formed of an elastomeric material which is resistant to solvent employed in the ink.
4. A print head unit as claimed in claim 3, in which the portion of the capping element that comes into contact with the face plate (12) is in the form of a facing pad (22) which abuts against the face plate (12) across all of the nozzles (14).
5. A print head unit as claimed in claim 3, in which the facing pad (22) of the capping element that comes into contact with the face plate (12) is in the form of a cap incorporating a continuous ridge around the portion of the face plate (12) in which the nozzles (14) are located.

6. A print head unit as claimed in any preceding claim, in which the capping element is mounted pivotally to the print head so that it can be swung into position against the face plate (12) in the capping phase and swung away from the face plate (12) into a retracted position for the printing phase.

7. A print head unit as claimed in any preceding claim, in which the capping element is motor-driven via a worm (19) and worm wheel (17).

8. A print head unit as claimed in any preceding claim, in which the wiping action is effected in a downwards direction.

9. A print head unit as claimed in any preceding claim, in which the wiper blade (29) comprises a resilient blade of elastomeric material which is resistant to solvent employed in the ink.

10. A print head unit as claimed in any preceding claim, in which one or more absorbent pads (15) are provided on or close to the print head to receive ink removed by the wiper blade (29).

11. A print head unit as claimed in any preceding claim, in which the path of travel of the wiper blade (29) is to move from a retracted position beneath the face plate (12), upwards past the face plate (12) without contacting it, moving into contact with the face plate (12) above the nozzles (14), moving downwards across the nozzles (14) while remaining in contact with the face plate (12) and then contacting an absorbent pad (15) before returning to the retracted position.

12. A print head unit as claimed in any preceding claim, in which the wiping element includes a frame to support the wiper blade (29).

13. A print head unit as claimed in claim 12, in which the frame comprises a triple-lever structure including a support lever (36) pivotally mounted on the print head, a



drive lever (38) pivotally and eccentrically mounted on a drive wheel (40), and a carrier lever (34) pivotally mounted at one end on the support lever (36) and holding the wiper blade (29) at the other end.

14. A print head unit as claimed in claim 13, in which the frame includes two such triple-lever structures, one on either side of the print head and linked to each other across the print head by tie bars (30, 32).

15. A print head unit as claimed in claim 14, in which the wiper blade (29) is disposed on a tie bar (30) which joins the ends of carrier levers (34).

16. A print head unit as claimed in any preceding claim, which includes separate drive motors for the [capping and wiping functions], shaped capping arm (16) and the movable wiping element.

17. A print head unit as claimed in any preceding claim, in which the range of movement of the respective elements is controlled by limit switches.

18. A print head unit as claimed in claim 16 and claim 17 in which the drive motors and associated switches are controlled by logic circuitry.

19. A print head unit as claimed in any preceding claim, in which the shaped capping arm (16) remains in a parked position during a wiping operation.

20. A print head unit as claimed in any preceding claim, in which the movable wiping element remains in a parked position while the shaped capping arm (16) is moved away from the face plate (12).

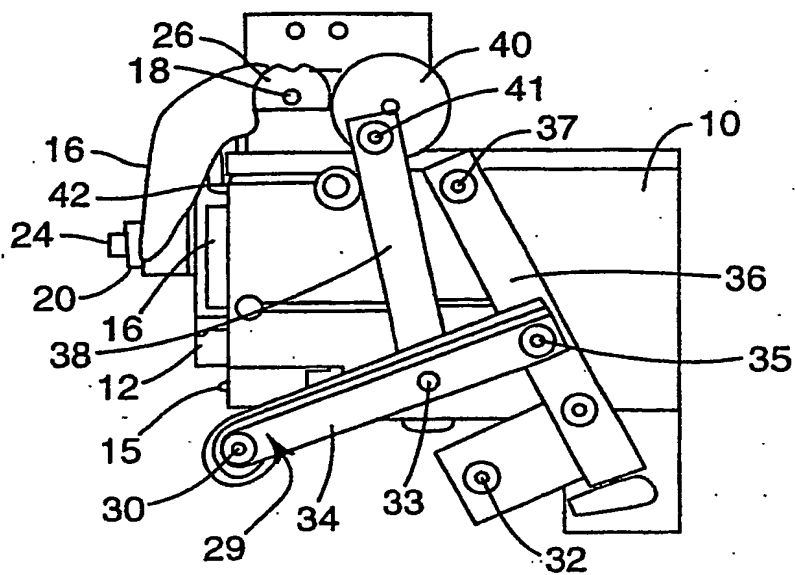
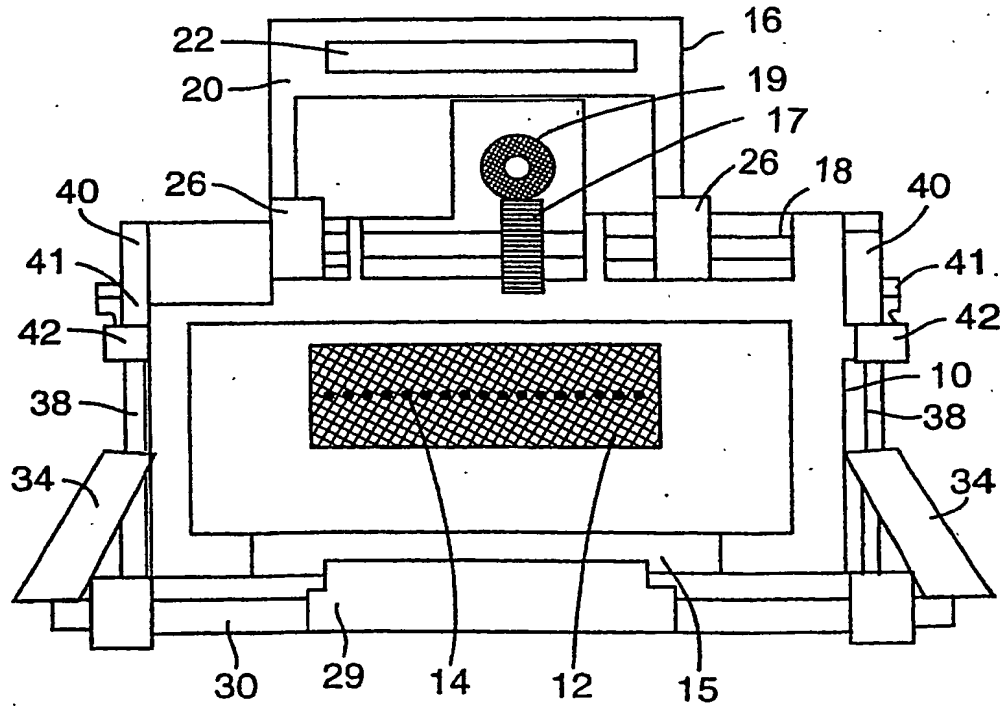
21. A print head unit as claimed in claim 10, in which the one or more absorbent pads (15) are positioned on the print head unit proximate to face plate (12).

22. A print head unit as claimed in claim 21, in which the one or more absorbent pads are removable from the print unit head and replaceable with replacement absorbent pads.

23. A printer incorporating a print head unit as claimed in any preceding claim.

24. A printer as claimed in claim 20, in combination with one or more microprocessors for control or monitoring purposes.

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**FIG. 3****FIG. 4**